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ETHYLIZATION:

The Anæsthetic Use of the Bromide of Ethyl.

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My observations of the anæsthetic action of the bromide of ethyl, which commenced in April, 1879, have been directed to its physiological action in the human subject, to its practical application in the relief of human suffering, and to its value as compared with other anæsthetics. Every administration has been carefully watched and studied, and records of its phenomena have been made as they were observed. From such basis of experience, I present some facts which may at least help toward a proper estimate and appreciation of its therapeutic value.

Since the publication of my recent articles on the subject in the *Philadelphia Medical Times*, my continued observations have been generally confirmatory of the statements then made. I now summarize the deductions from my entire experience in the anæsthetic use of the bromide of ethyl, and present my convictions in regard to its comparative value.

The terms bromide of ethyl and hydrobromic ether are arbitrarily applied by chemists, in accordance with differing chemical nomenclature; but, for distinctiveness, and without reference to chemical accuracy, I prefer the former expression. I prefer to give to the substance the generic name of ethyl, and speak of ethylizing and ethylization on the same grounds, as, by common consent, the words ether and etherization are applied to sulphuric ether.

The decided characteristics of the administration are its rapidity of action and the quickness of recovery from its impression. I have produced complete anæsthesia in cases of young children in less than one minute. The longest period required to produce the anæsthetic state in adults has not exceeded five minutes.

The ethylized patient recovers much more rapidly than is the case with chloroform or ether. Intellection and muscular co-ordination are regained very soon after the inhalation has ceased. In some instances these functions return as quickly as after the administration of the nitrous oxide gas, and frequently the patient, on awaking, is able to at once stand erect and to walk.

If the anæsthetic impression be slowly effected, a brief period of intellectual excitement, associated with muscular action or rigidity, may occasionally be manifested; but violent emotion and struggling, if they should occur, are more moderate, brief, and transient than in the early stage of the anæsthesia of ether or chloroform. The stage of excitement can generally be avoided by making a rapid impression of the anæsthetic. I have observed that persons accustomed to the habitual use of alchoholic stimulants are less readily impressible by anæsthetics generally, and with them a stage of excitement is apt to precede anæsthesia. In this class of subjects narcotics act as stimulants, and the same holds true with regard to anæsthetics.

As anæsthesia is developed the circulation generally shows evidences of moderate excitement, as indicated by some increase in the rapidity of action of the heart, and the pulse evinces greater general arterial tension. The face of the patient usually becomes brightly flushed, and, when anæsthesia is profound, the forehead and the general surface are apt to be moist with sweat. In these respects the anæsthesia of the bromide of ethyl differs from the ordinary pallor of countenance and the usual check of skin-transudation of chloroforming.

The physiological action of the bromide of ethyl does not incline to the dangers of cerebral anæmia and cardiac syncope, which sometimes occur in chloroforming, and, in my experience, no tendencies in such directions have seemed to threaten.

The respiration is slightly increased in frequency until anaesthesia becomes complete, when it assumes the characteristics of normal sleep. The decided indication of the attainment of very profound anaesthesia is the slowing of the patient's breathing, as in ordinary sleep, which becomes easy, long, and free. The irritation of the respiratory passages, which often inconveniences the inhalation of ether, does not occur in any degree with the bromide of ethyl. If brought into contact with the skin of the face, it is less irritating than chloroform.

I do not recognize any ordinary after-effects on awaking from the anaesthesia of bromide of ethyl, the patient speedily returning to his normal sensations and usual condition with but a drowsy sense continuing for a brief time. In my own person, the whole impression is more agreeable than is that of ether or chloroform; and others who have thus tried comparatively the different anaesthetics have expressed to me the same appreciation.

The liability to nausea and vomiting is less than after ether and chloroform, but it is not entirely avoided. Occasionally vomiting will occur when food has been but recently taken, and I have in a few instances observed decided nausea and retching when no food was in the stomach, and merely some frothy mucus was ejected. The quick relief from the anaesthetic impression of the bromide of ethyl seems to render less likely the long continuance of the distressing nausea and vomiting which are liable to follow etherization and chloroforming. It should be borne in mind that the fully anaesthetized patient never vomits, and the manifestation of nausea during the continuance of the inhalation is the indication for making the impression more profound. When vomiting occurs and persists after anaesthesia passes off, it can best be relieved by giving to the patient small pieces of ice to swallow, or a full draught of ice-water.

The quantity of the bromide of ethyl required to pro-

duce anaesthesia varies with individual susceptibility and with the manner of using it. Its rapid evaporation causes much loss by diffusion in the atmosphere, but this waste may, with a view to economy, be to some extent avoided. I am in the habit of administering it by pouring two or three fluidrachms on several folds of woven lint, or on a small, soft linen handkerchief, over which is pinned a napkin, folded large enough to cover the entire face of the patient. Anaesthesia is, in my experience, more quickly obtained without the intervention of excitement, if light is excluded, and the temptation to look about avoided, by covering the eyes with a napkin. This plan seems to me to be the simplest and the best, and I trust that the anaesthetic use of the bromide of ethyl may never become complicated or embarrassed by any forms of the absurd contrivances called inhalers. Such apparatus implies that all individuals are, under all circumstances, to be dosed with anaesthetics in the same mechanical manner. Nothing can be gained by any mechanical device for the purpose, excepting economy in the use of the anaesthetic, and some of the numerous devices would rather tend to wastefulness. A simple napkin or piece of lint, or both together, which absorb and gradually exhale the vapor, are perfectly effective and controllable as the means of administration, and nothing more can be required. With an extremely economical object, the texture upon which the anaesthetic is poured may be covered with an impervious material, or by a napkin dampened with water.

In commencing the inhalation of the bromide of ethyl, I prefer always to make a rapid and decided impression, with the lint and napkin held closely over the nose and mouth of the patient. It is the object to attain anaesthesia without the intervention of mental and muscular excitement. In the administration of another anaesthetic—the nitrous oxide gas—we are familiar with the uncontrollable excitement liable to be produced by slowly inhaling small

quantities; and we know as well what profound anæsthesia is induced by rapid and impressive doses of the gas. In the method which I prefer of administering the bromide of ethyl from a piece of folded lint and a napkin, it does not seem possible to exclude so much atmosphere as to cause danger from asphyxia. The air which, through the open texture of the material and from lateral directions, reaches the lungs, must really contain but a small percentage of the vapor, and at every expiration it is forcibly blown away.

In my experience the entire quantity of ethyl consumed in effecting and continuing anæsthesia in any single case has varied from one fluidrachm, used in a very brief period, to eleven drachms required in maintaining anæsthesia through an operative procedure of forty minutes' duration.

After having tranquilized the patient's mind by assurances of freedom from suffering and danger, I direct him to inspire and expire, for a time, as deeply as possible. The expirations should be so complete that the residuary air is expelled from the lungs. While continuing to thus breathe deeply, the inhalation is commenced.

This preliminary drill I regard as important, and it will always facilitate the proper production of anæsthesia. Until complete anæsthesia is effected there should not be allowed a moment during which the patient does not inhale the vapor, and as the anæsthetic becomes exhausted it should be quickly replenished.

It is proper that the administrator of any anæsthetic should be able to recognize and be satisfied with the simple production of the anæsthetic state—insensibility to pain—without pushing the inhalation, as is often through ignorance or carelessness done, to a dangerously toxic condition. The best indication of complete anæsthesia is the change in the breathing of the patient to that of ordinary deep sleep. When anæsthesia becomes profound

there may be a more or less snoring or puffing sound, due to relaxation of the palatine and buccal muscles. With such manifestations the administration should cease or be very moderately continued. It should be borne in mind that all anaesthetics become eventually, by continuance, depressing agents, and their administration should not be viewed as a matter of trifling responsibility, and entrusted to careless or inexperienced persons. The administrator should exclusively direct his attention to what he is entrusted with, regarding only the condition of the patient, and not observing the operative proceeding. I have witnessed an ignorant and heedless assistant resting his elbows on the chest of a patient, whose labored respiration and livid, turgid face showed threatening asphyxia, while the administrator gazed abstractedly at a surgical procedure taking place at the groin.

I cannot too much impress the greater importance of observation and reliance on the state of the respiration, rather than of the circulation, as an index of the condition of the ethylized patient.

The patient's position, should, if possible, be that of dorsal recumbency, with the head slightly elevated and flexed. It is well to remember that in the sitting or erect positions there may be more danger to very feeble patients from syncope. During muscular excitement the neck should not be allowed to be forcibly curved backward, as is the tendency, producing tension on the ante-tracheal muscles and impeding venous return. The chest and abdomen should be free from the mechanical restraint of tight clothing, so that full and deep inspiration may not be impeded. If it should be necessary to have the patient in the prone position, the administration requires watchfulness lest respiration should, by pressure become embarrassed.

When practicable, the taking of solid food should be avoided by a patient for four hours, and liquid food for

three hours before the administration of any anæsthetic. If the patient's condition should be feeble, alcoholic stimulants or ammonia may in advance be given. When, in an emergency, anæsthesia must be induced very soon after a meal, the act of vomiting should be carefully watched, and the patient's trunk so held that ejected substances may not gravitate into the larynx.

No fatal case referrible to the action of the bromide of ethyl has occurred, nor even in the now large number of administrations, as far as I am aware, have there been any dangerous or threatening symptoms; yet, just as in what ought to be the almost invariably safe administration of sulphuric ether, death may occur, but it will most probably, be in cases in which, if proper care had been observed, the fatal result would have been avoided. Its action does not seem insidious or uncertain; but, judging from the careless and bungling manner in which other anæsthetics are sometimes administered by incompetent persons, I think that so agreeable and unirritating an agent as the bromide of ethyl is liable to be ignorantly, heedlessly, and inordinately used, and its usual harmless and beneficent anæsthesia pushed to toxic conditions and even death.

In the minor operations of surgery, occupying but a very brief time, and of but momentary pain, it is sufficient evidence of the production of anæsthesia when the patient does not respond to a sudden call by the voice. The more profound state of anæsthesia is evinced by insensibility of the surface of the conjunctiva to the touch of the finger, and by change in the breathing of the patient to that of normal deep sleep. The occurrence during full anæsthesia of dilatation of the pupils and of general sweating, are frequent, but not invariable phenomena of ethylization.

The bromide of ethyl, as most recently produced by our best chemists, differs materially in some of its sensible properties from that which has generally been described by chemical writers, and from that which I first had the opportunity of using.

Its odor is characteristic, but is less decided than that of ether or chloroform, and to most persons it is more agreeable. The article I now use leaves less evidence on the breath of the patient, is soon dissipated from the apartment, and the odor does not remain, as does that of ether, on the clothing of the operator and his assistants.

The bromide of ethyl is said to be liable to chemical change by prolonged exposure to light, but I have kept daily, for more than a month, exposed to direct sunlight, a specimen made by Wyeth & Bro., of this city, and can perceive no evidence of change in either its ordinary properties or its anæsthetic action.

The bromide of ethyl may always be used without danger, in the closest proximity to lights and to the actual cautery, as its vapor is not inflammable. If a few drops be poured into a tumbler, or other deep vessel, a lighted taper or a match is at once extinguished if immersed in the vapor.

I have used the bromide of ethyl in the surgery of two large general hospitals and in private surgical practice, under the most varied circumstances which could be required to test the merits of an anæsthetic. In my use of it in the most abnormal conditions of debility and shock of injury, in capital operations, through protracted periods of administration, in patients from early infancy to extreme old age, it has always been satisfactory and free from manifestations of danger. I express my conviction that it is practically the best anæsthetic known to the profession.

